

**SCHEMATIC
DIAGRAM**

CRUMAR[®]

Musical Instruments

mod.

915



FEMALE CONNECTOR SYMBOL (es. K2.1)



PLUG IN CONNECTOR SYMBOL



OUTPUT SIGNAL (TO DWG...)



INPUT SIGNAL (FROM DWG...)



TEST POINT (TP...)



CONNECTING POINT (ON p.c.b.)

ALL resistors 1/4 unless otherwise indicated

ALL tabswitches shown in OFF position

ALL keyswitches shown in OFF position

See part list for component part numbers

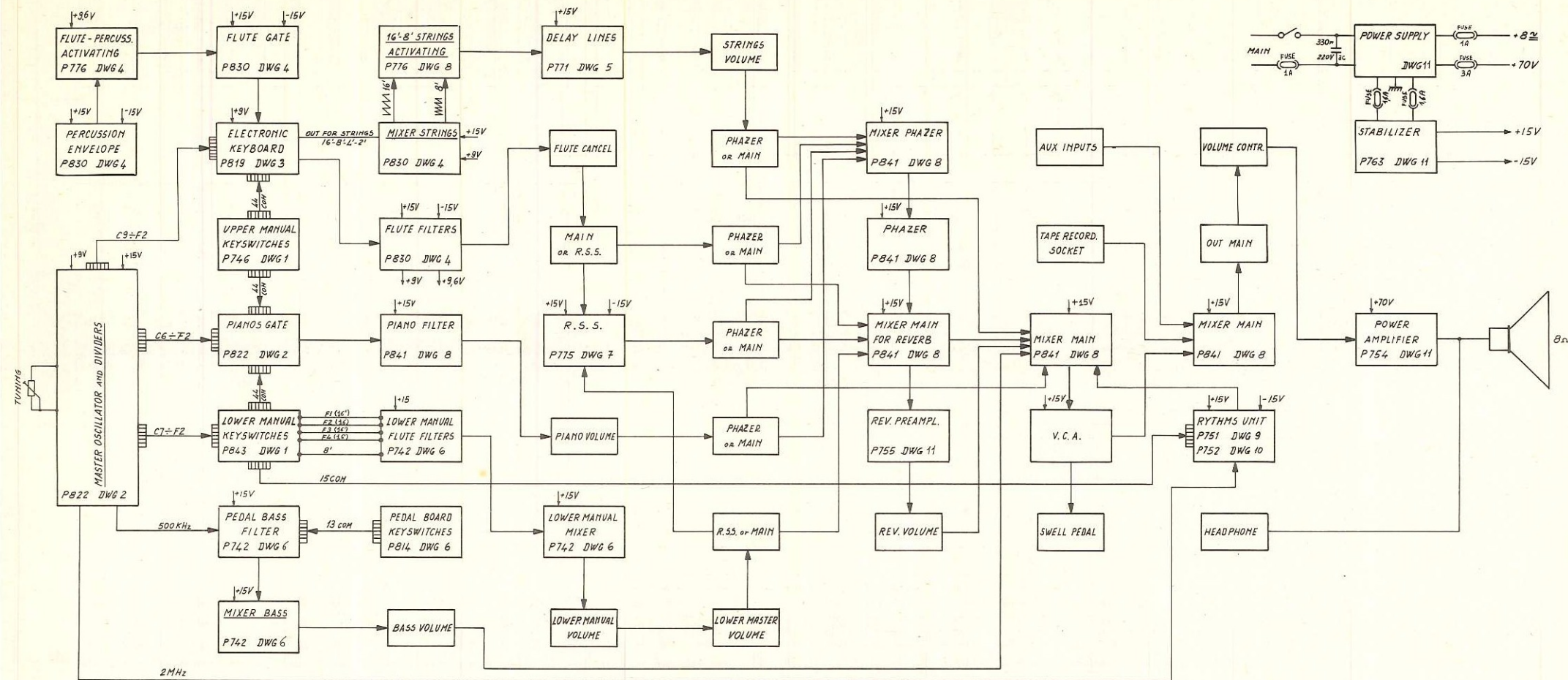
**SCHEMATIC
DIAGRAM**

**mod.
915**

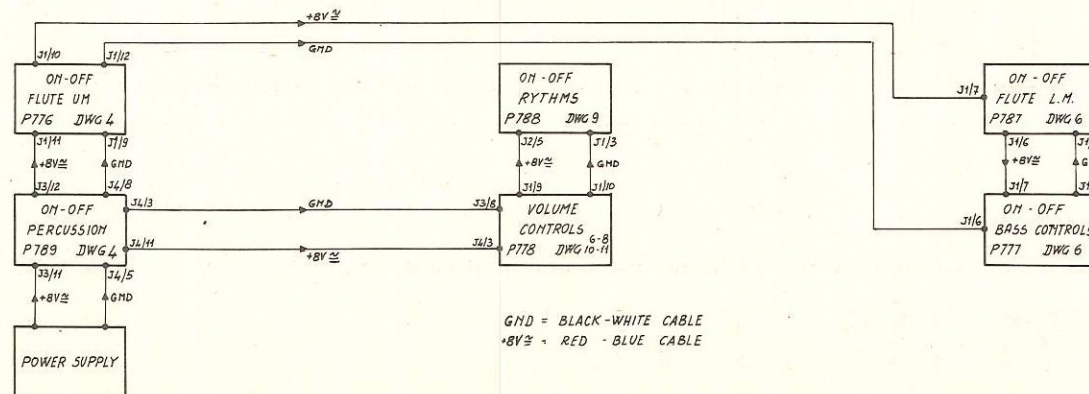
INDEX

DWG 1 (P-843)	= LOWER MANUAL KEYING CIRCUIT	DWG 8 (P-776)	= FLUTES STRINGS PIANOS CONTROLS
DWG 1 (P-746)	= UPPER MANUAL KEYING CIRCUIT	DWG 9 (P-751)	= ACCOMPANIMENT SECTION (LOGIC)
DWG 2 (P-822)	= MASTER OSCILLATOR AND DIVIDERS	DWG 9 (P-757)	= PRESS-BUTTON ASSEMBLY FOR RHYTHMS ON ACCOMPANIMENT SECTION
DWG 3 (P-818)	= MODULES FOR ELECTRONIC KEYBOARD	DWG 9 (P-788)	= PRESS-BUTTON ASSEMBLY FOR CONTROLS ON ACCOMPANIMENT SECTION
DWG 3 (P-819)	= ELECTRONIC KEYBOARD	DWG 9 (P-761)	= VOL. REVERB. - VOL. VIB. CHORUS - VOL. TEMPO RHYTHMS - VOL. PIANO BASS
DWG 4 (P-776)	= FLUTE-PERCUSSION ACTIVATING	DWG 10 (P-752)	= ACCOMPANIMENT SECTION (NOISES)
DWG 4 (P-830)	= FLUTE FILTER - MIXER STRINGS AND PERC. ENVELOPE	DWG 10 (P-761)	= VOL. REVERB - VOL. VIB. CHORUS - VOL. TEMPO RHYTHMS - VOL. PIANO BASS
DWG 4 (P-789)	= SUSTAIN PHASER PERCUSSION CONTROLS	DWG 10 (P-842)	= VOLUME CONTROLS
DWG 5 (P-771)	= DELAY LINES	DWG 10 (P-788)	= PRESS-BUTTON ASSEMBLY - FOR CONTROLS ON ACCOMPANIMENT SECTION
DWG 5 (P-790)	= DELAY LINES	DWG 11 (P-753)	= POWER SUPPLY FILTERS
DWG 6 (P-742)	= PEDAL BASS FILTER AND LOWER MANUAL MIXER	DWG 11 (P-754)	= AMPLIFIER
DWG 6 (P-814)	= PEDAL-BOARD KEYSWITCHES	DWG 11 (P-755)	= REVERB
DWG 6 (P-777)	= BASS CONTROLS	DWG 11 (P-763)	= POWER SUPPLY
DWG 6 (P-841)	= VOLUME CONTROLS		
DWG 6 (P-787)	= LOWER MANUAL FLUTE CONTROLS		
DWG 7 (P-775)	= ROTATING SOUND SISTEM		
DWG 8 (P-841)	= PHASER-MIXER AND FINAL PRE-AMPLIFIERS		

BLOCK DIAGRAM



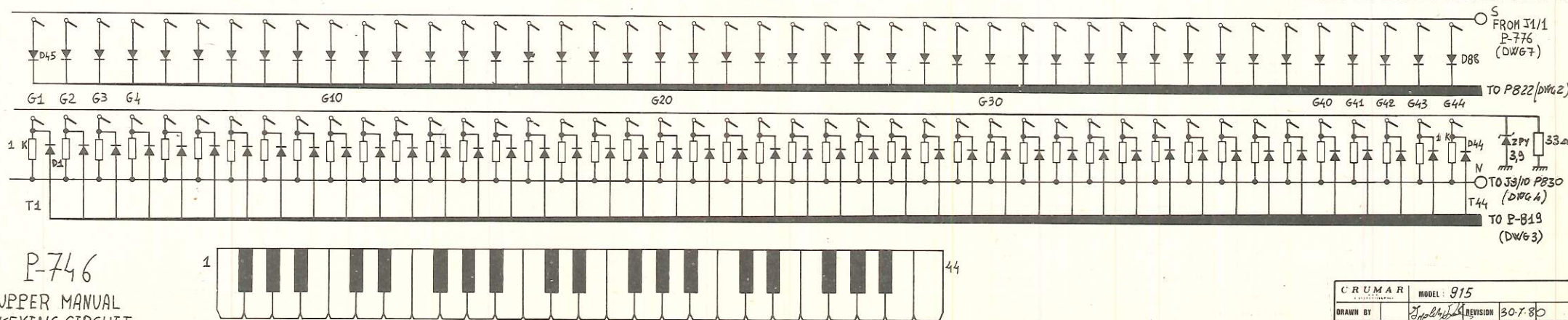
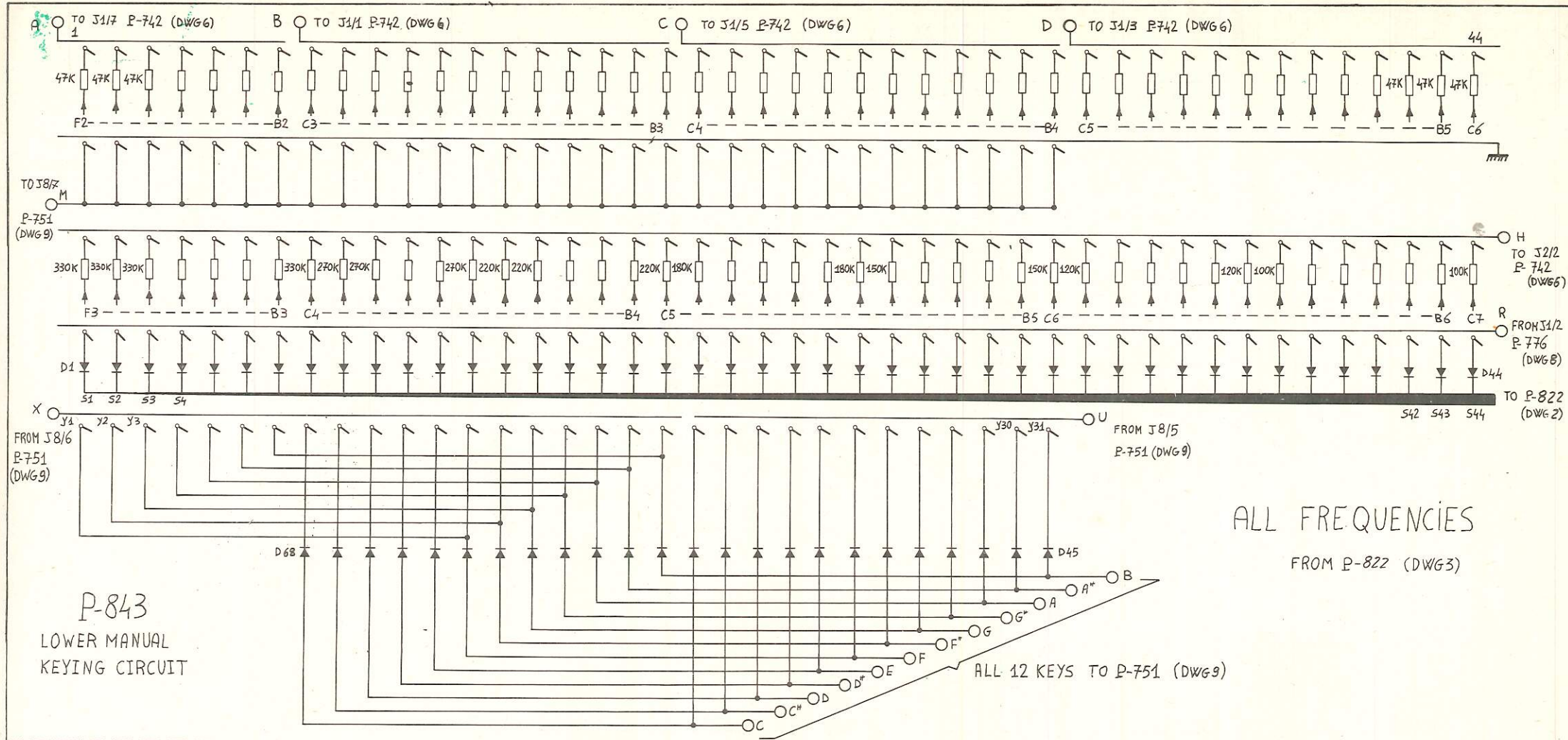
BLOCK DIAGRAM FOR LED SECTION



GND = BLACK-WHITE CABLE
+8V± = RED - BLUE CABLE

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DRAWN BY	Borini G.	REVISION	30-7-80
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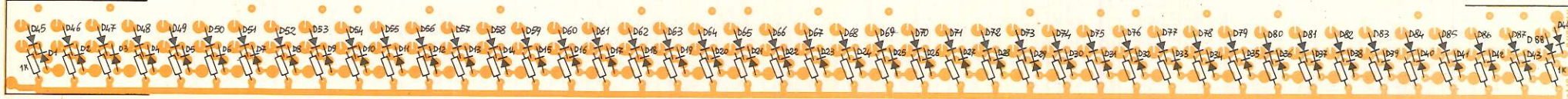
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MOSTRATO A TERZI SENZA NOSTRA APPROVAZIONE SCRITTA



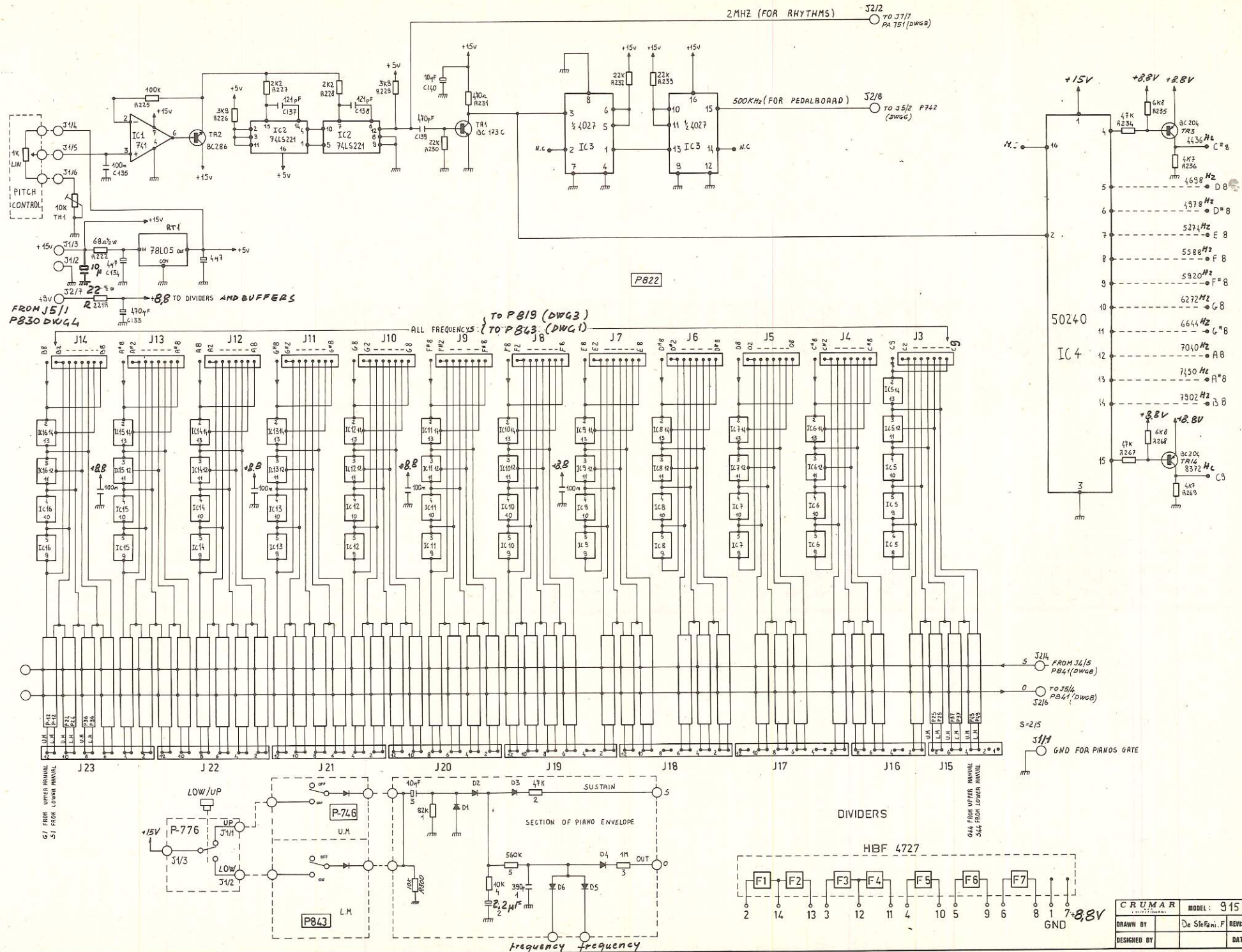
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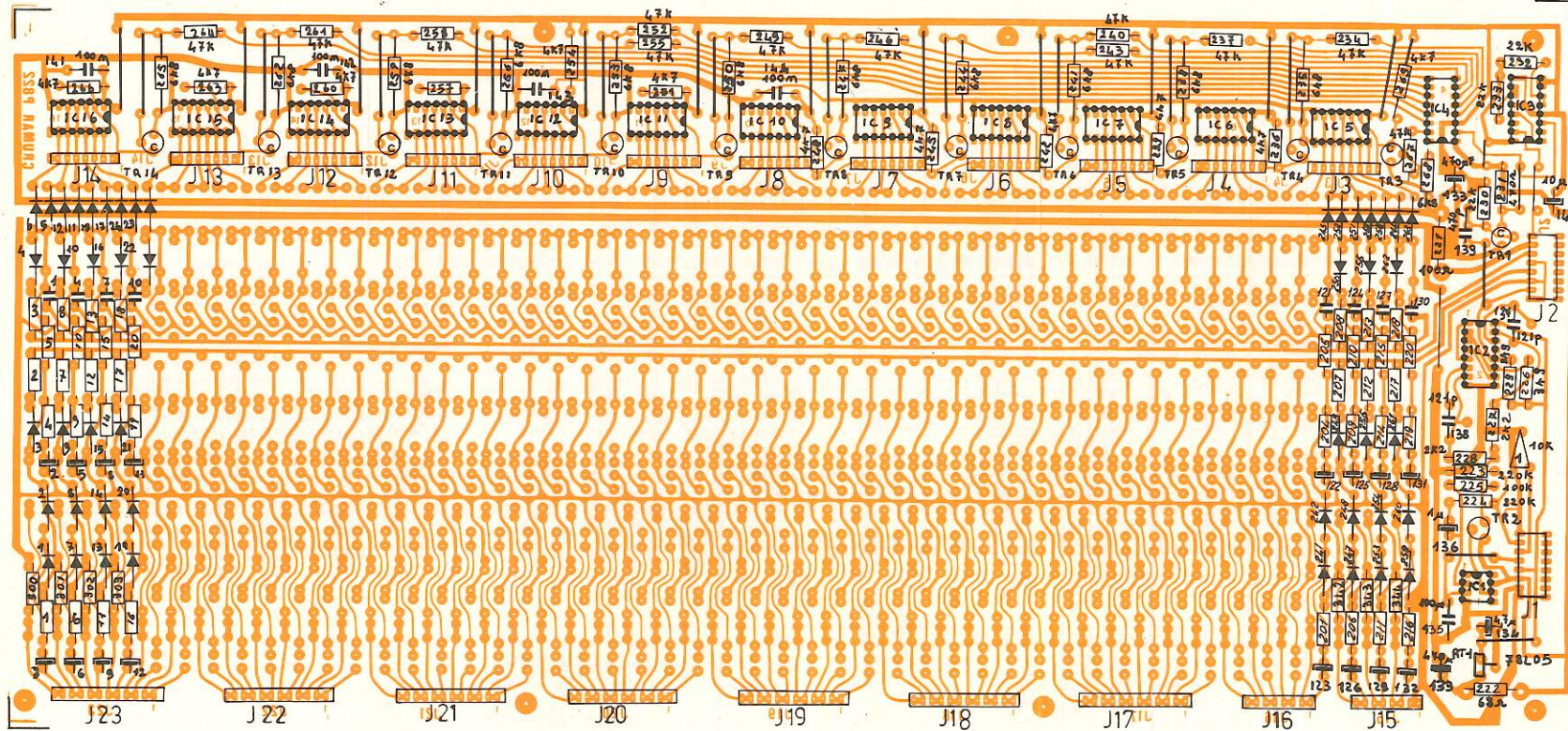
P-746



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P.822



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DRAWN BY	DESIGNED BY	REVISION 30-7-80
DESIGNED BY	DATE	

DWG 2A

QUESTO DISEGNO È PROPRIETÀ PRIVATA E NON PUÒ ESSERE COPIATO RIPRODOTTO
MOSTRATO A TERZI SENZA NOSTRA APPROVAZIONE SCRITTA

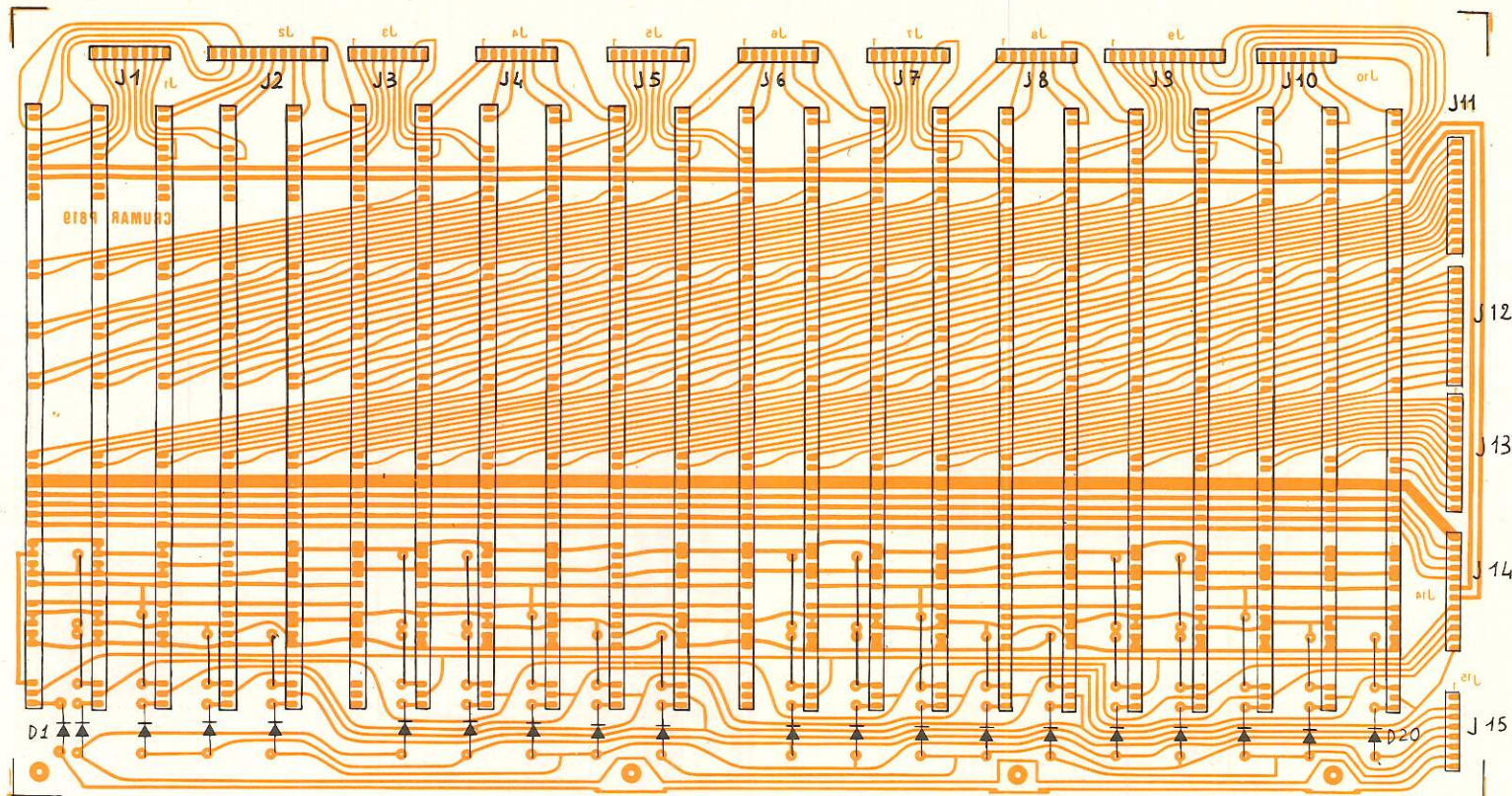
Figure 1 shows 10 DNA samples (J1 to J10) used in the study. Each sample is represented by a horizontal bar with 24 positions. Above each bar is the sample name and 'DWS' number. Below each bar are two rows of numbers representing nucleotide frequencies. Row 1 (top) contains values from 1 to 24. Row 2 (bottom) contains values from 1 to 24, with some values being 0 or 1. The samples are arranged in two rows of five.

Sample	DWS	Row 1 (Top)	Row 2 (Bottom)
J1	FROM P7L6 DWS1	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
J2	FROM P8Z2 DWS2	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
J3	FROM P7L6 DWS1	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
J4	FROM P8Z2 DWS2	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
J5	FROM P8Z2 DWS2	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
J6	FROM P8Z2 DWS2	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
J7	FROM P7L6 DWS1	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
J8	FROM P8Z2 DWS2	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
J9	FROM P7L6 DWS1	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
J10	FROM P8Z2 DWS2	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

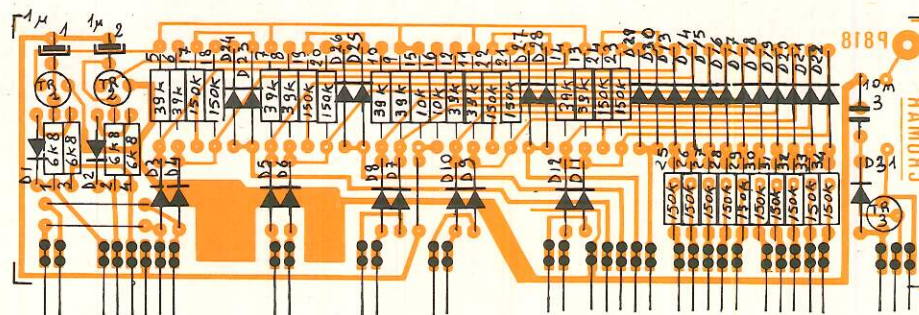


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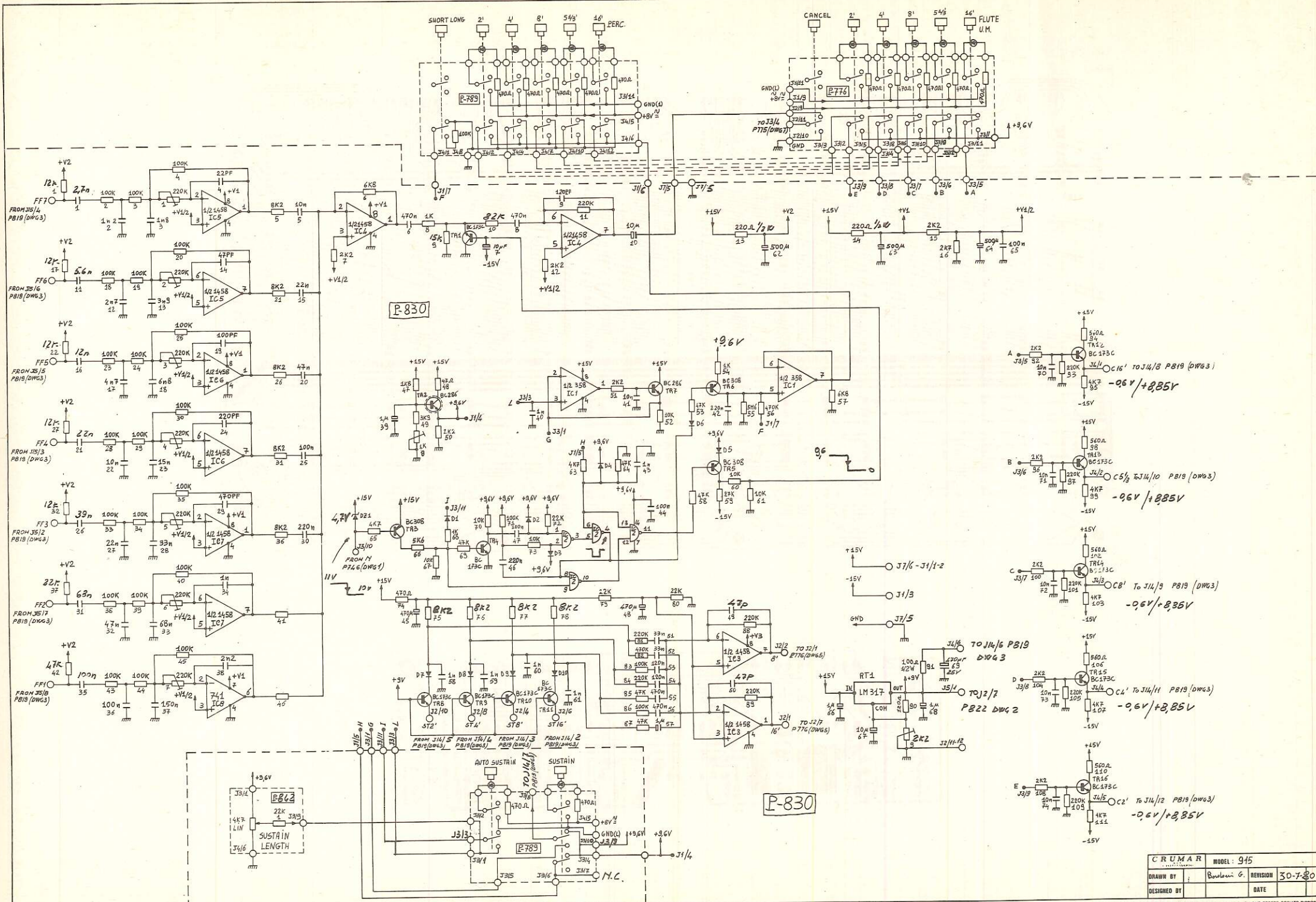
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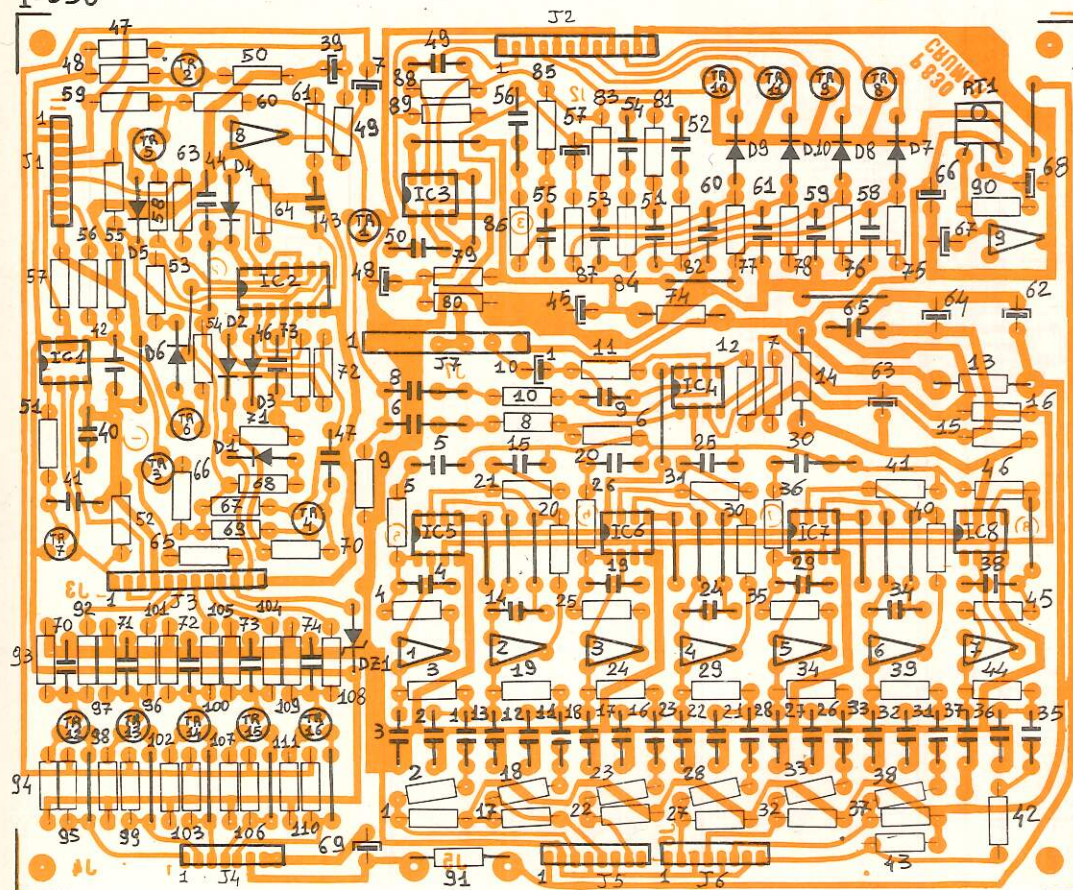
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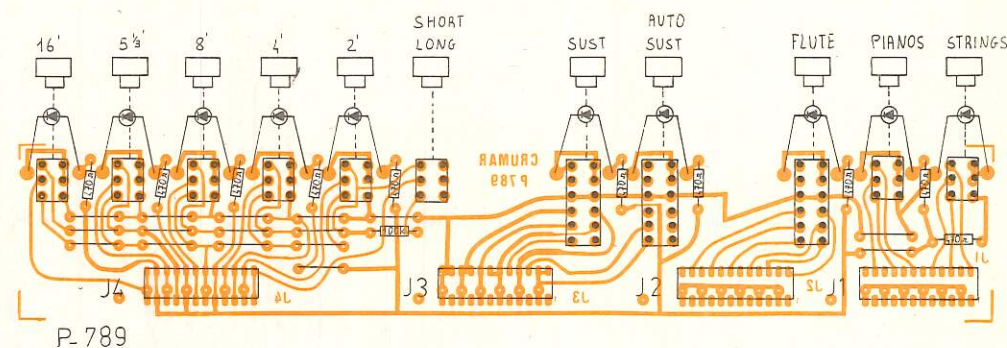
P-830



PERCUSSION

SUSTAIN

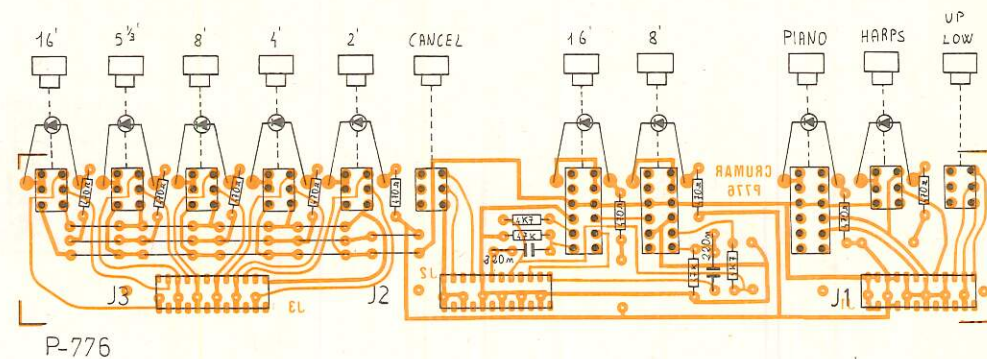
PHASE



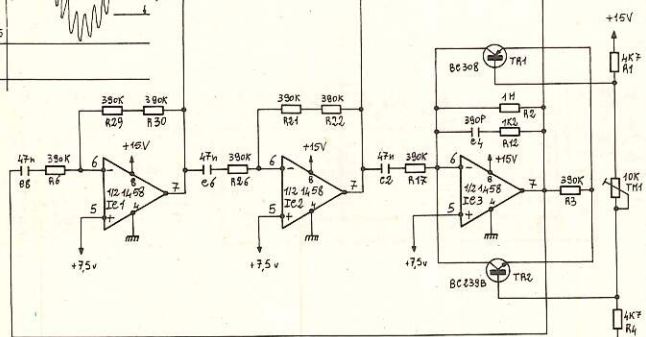
FLUTES

STRINGS

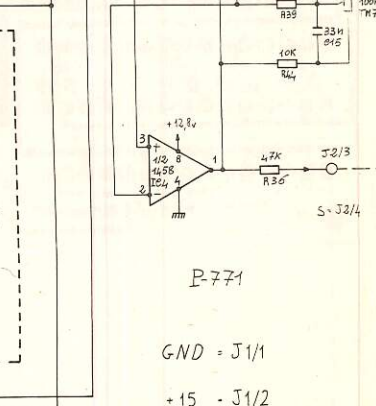
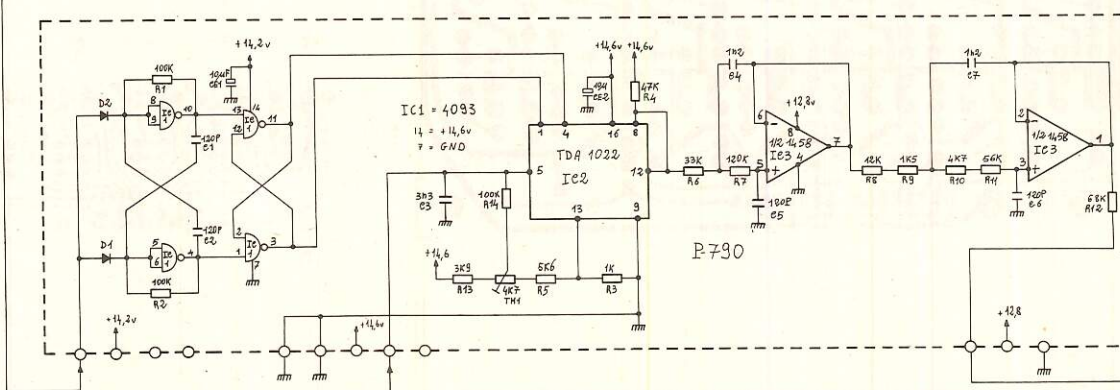
PIANOS



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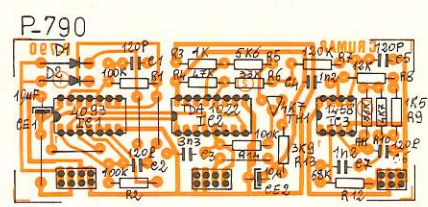
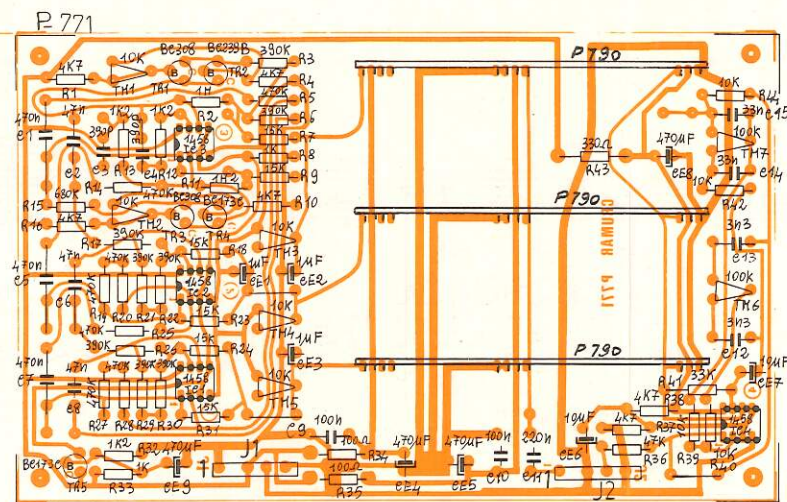
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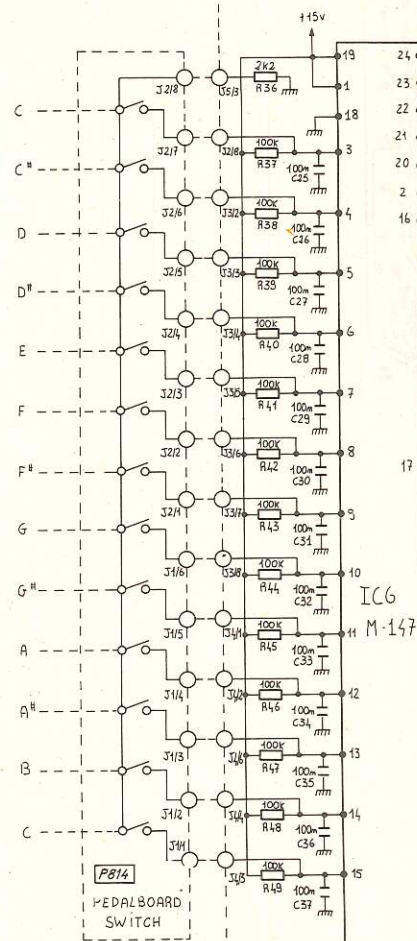
P-771

$$GND = J1/1$$

+ 15 - J1/2

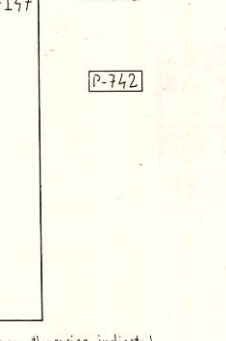
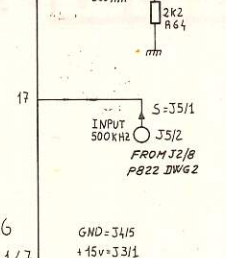
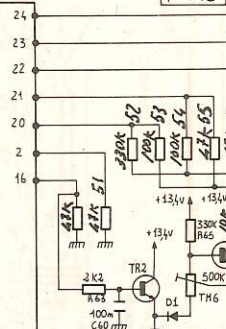


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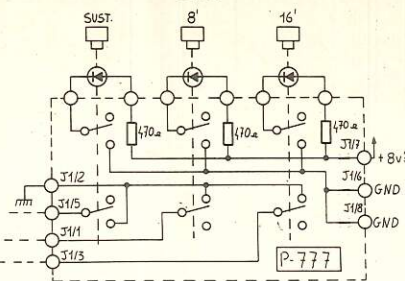
BASS-FILTER

P-742



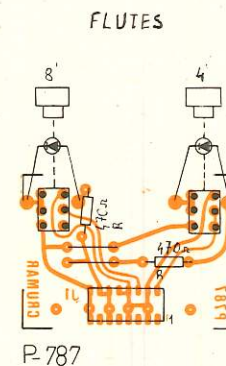
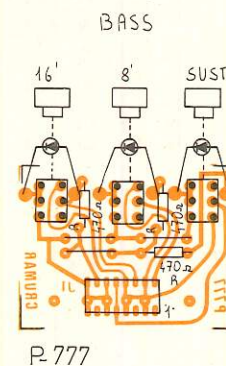
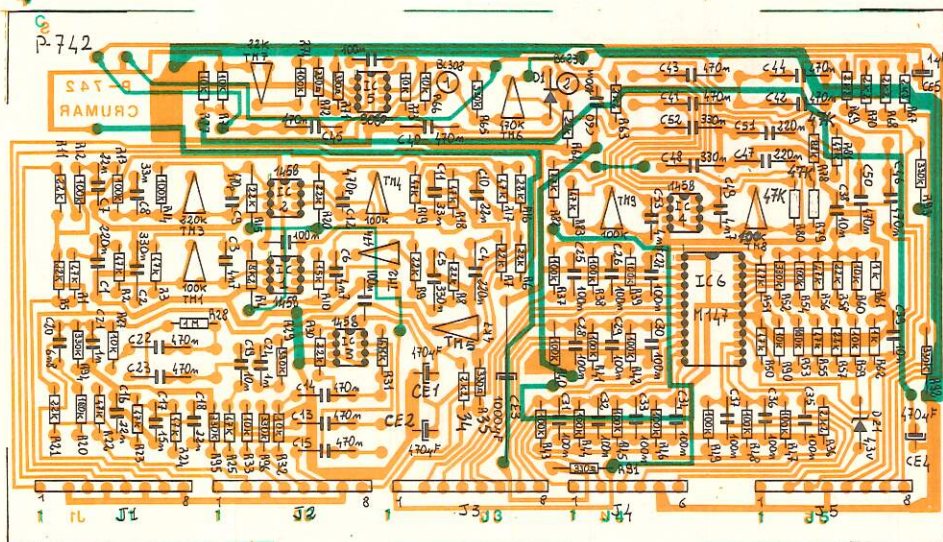
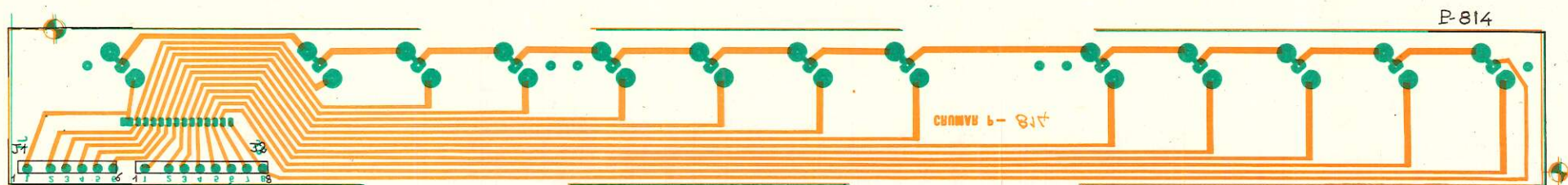
All resistors 1/4W unless otherwise indicated
All tabswitches shown in OFF Position
All Keyswitches shown in OFF Position
See parts list for component part numbers

BASS



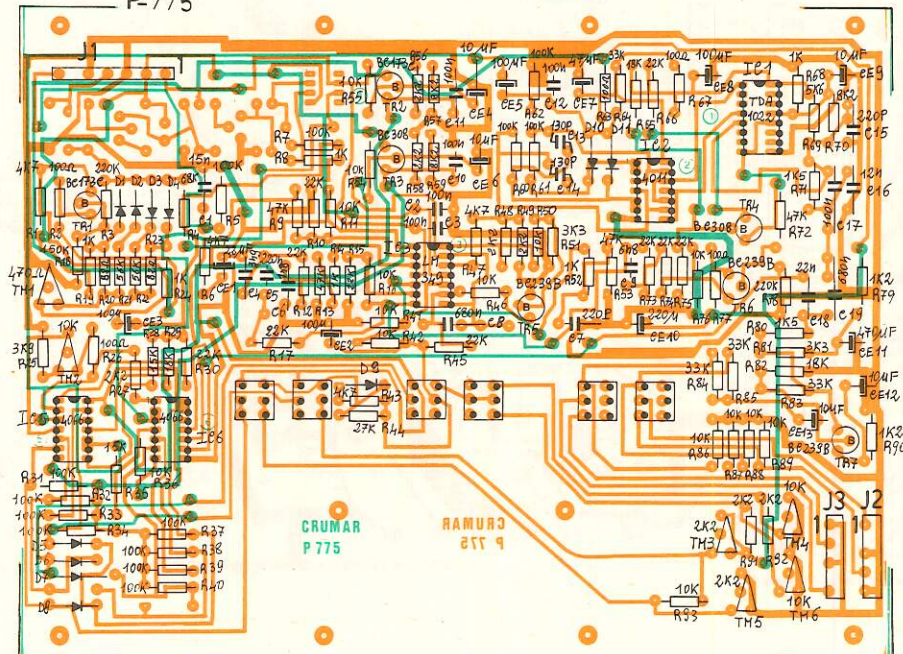
LOWER MANUAL FLUTE FILTER

P-742



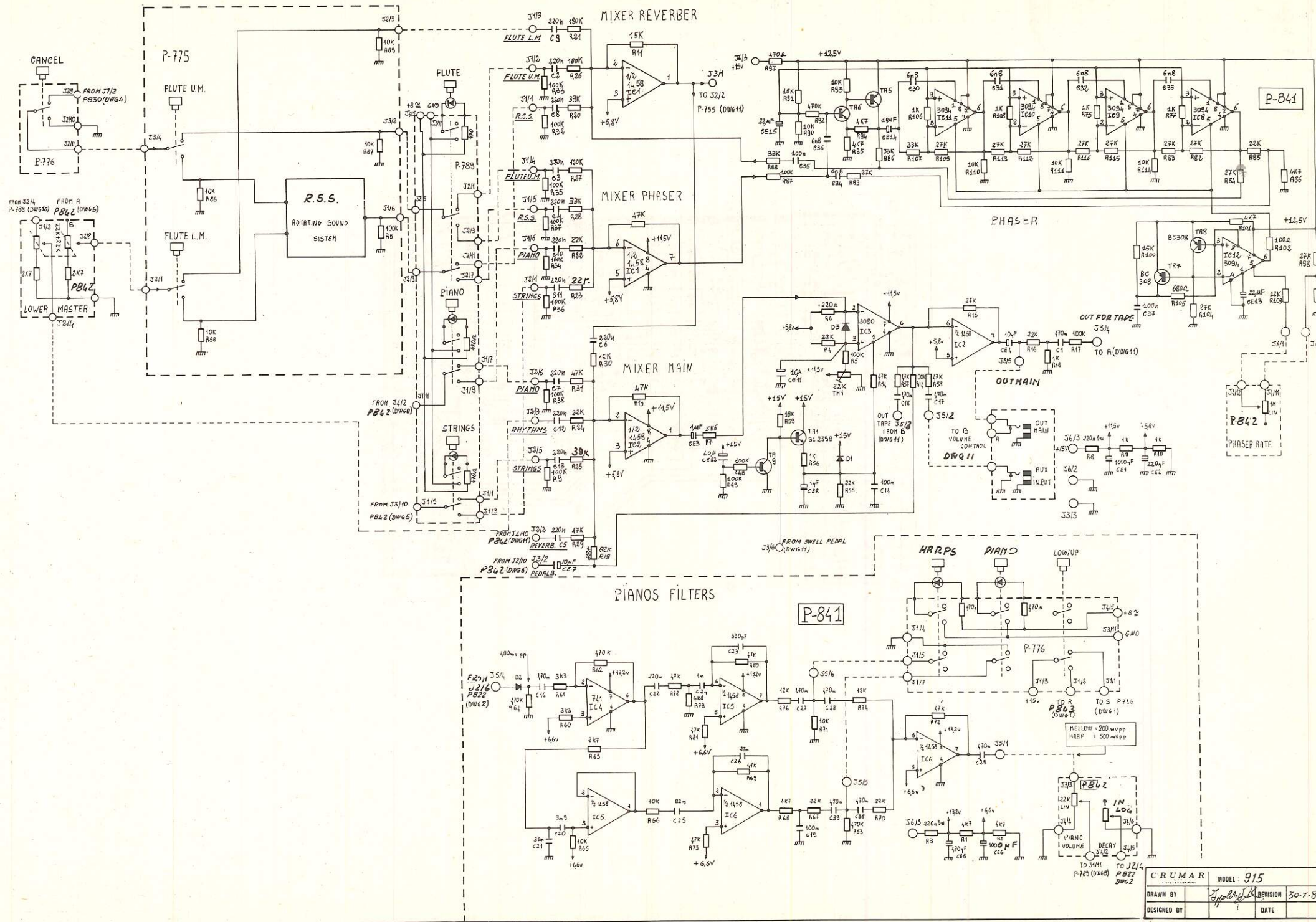
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P-775

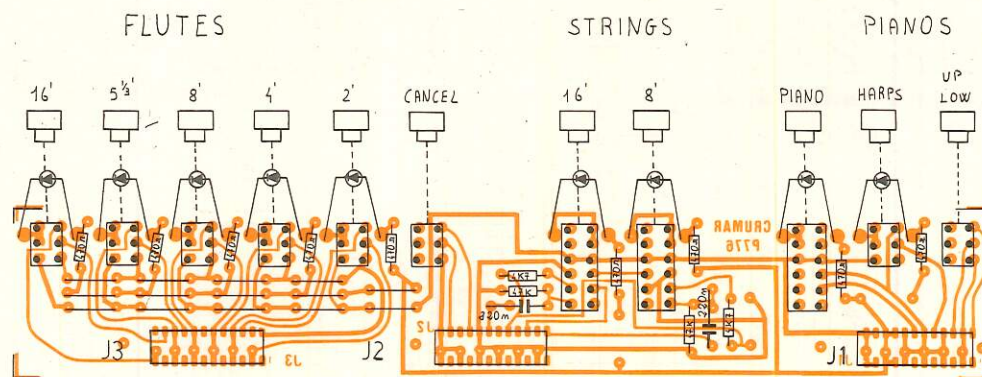
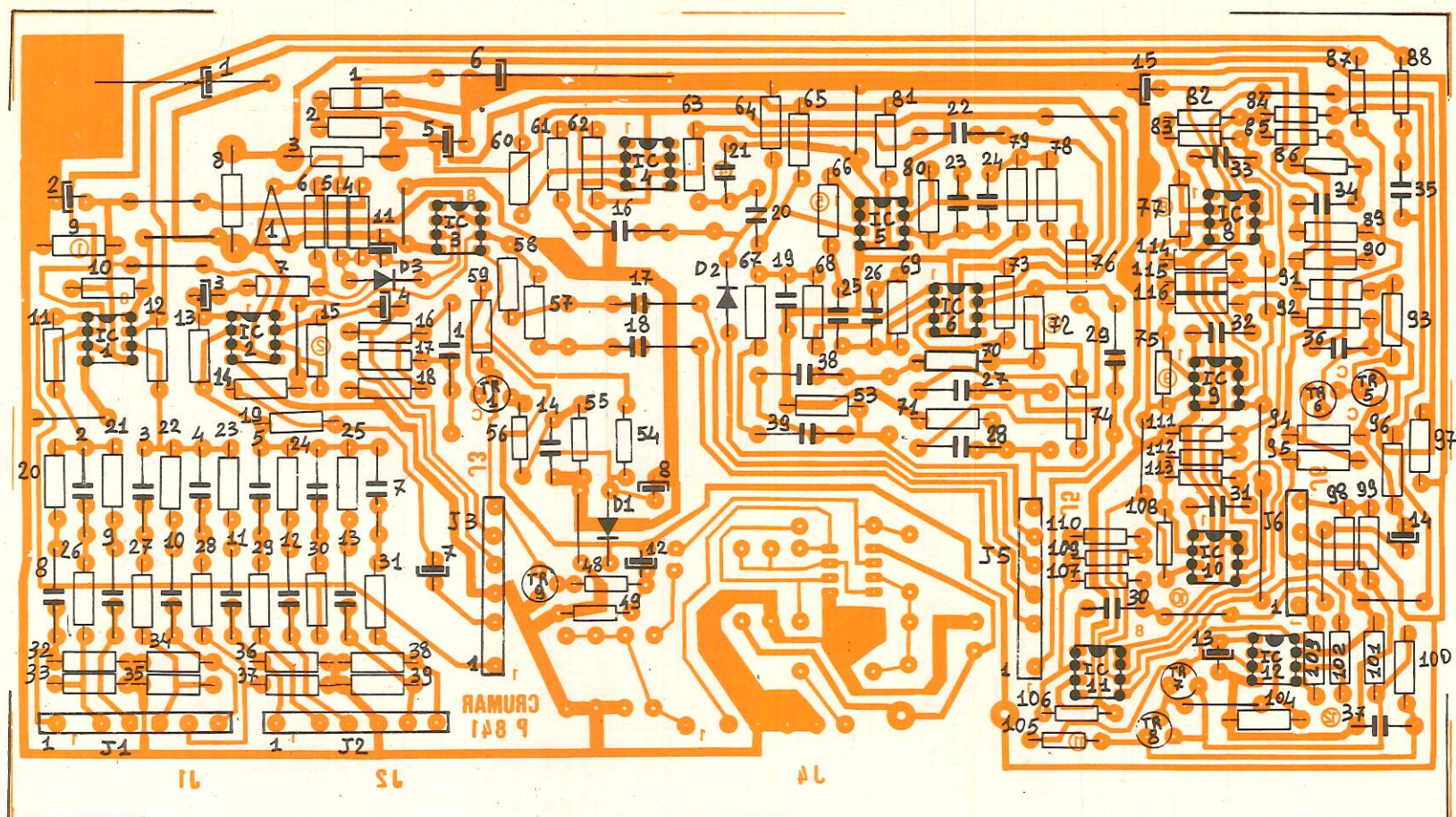


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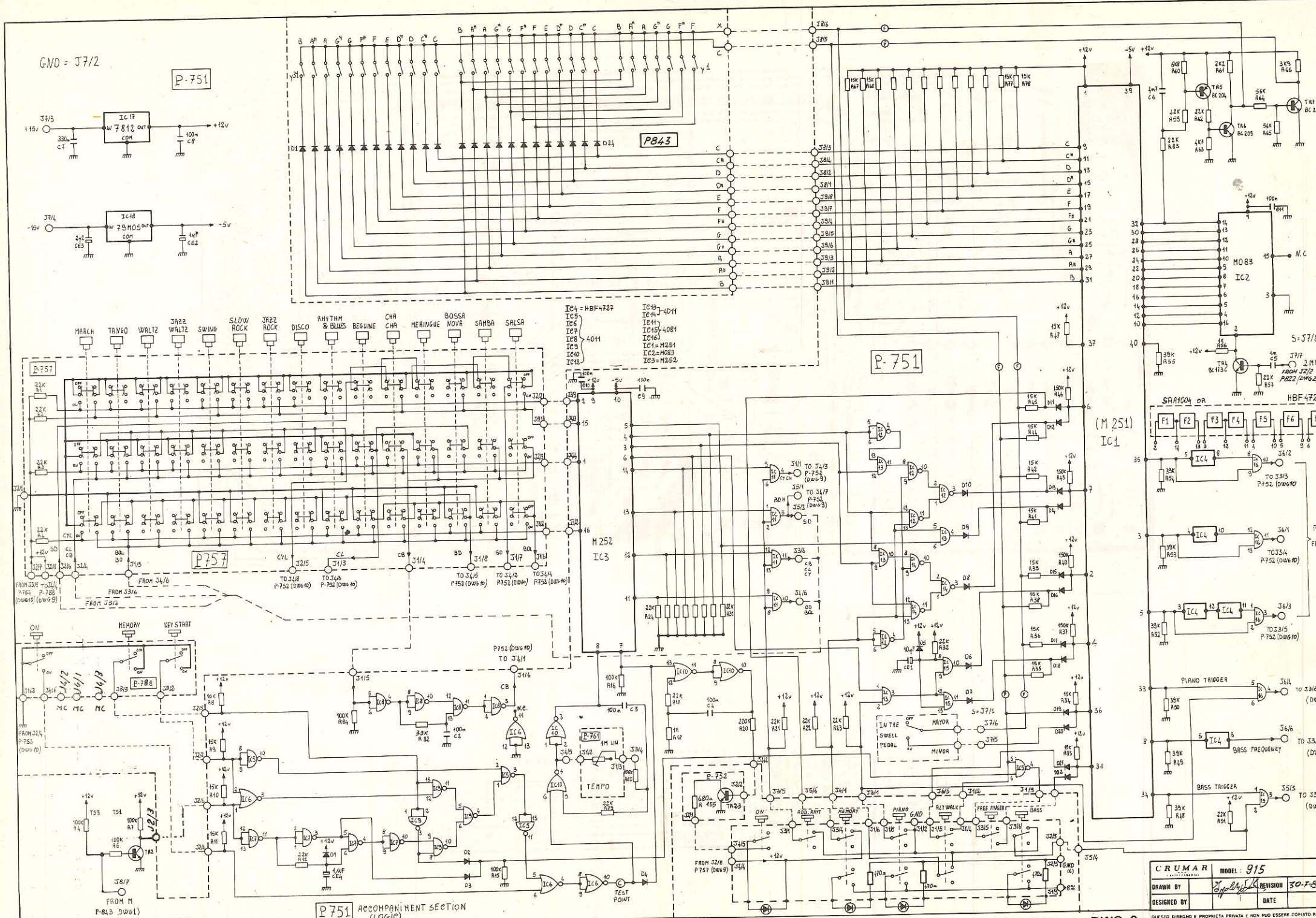


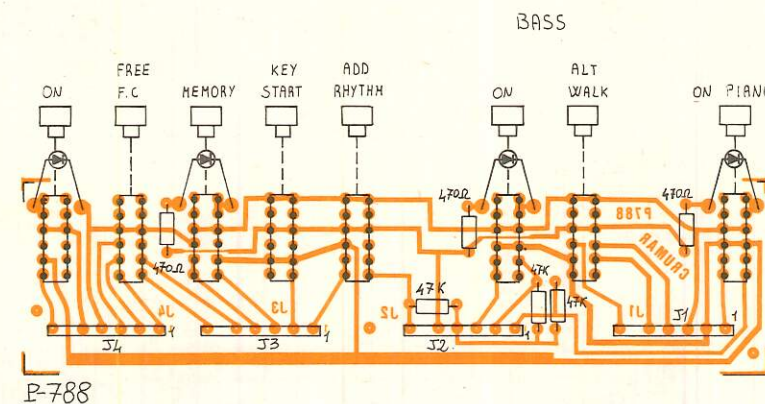
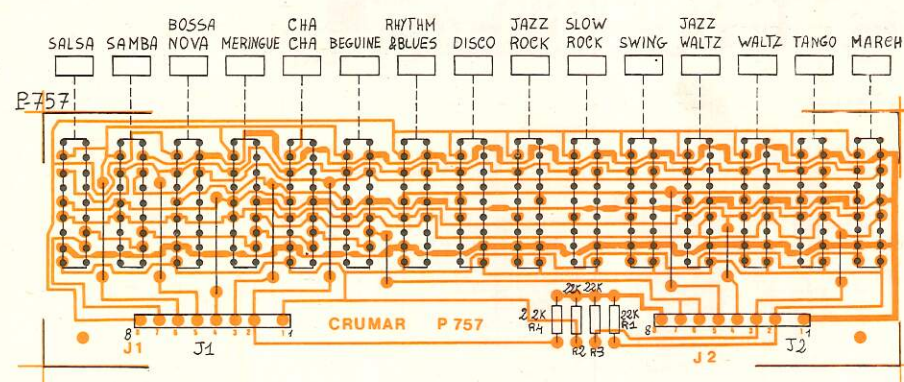
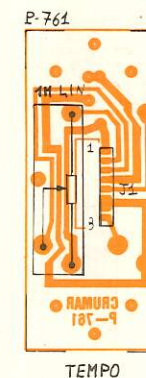
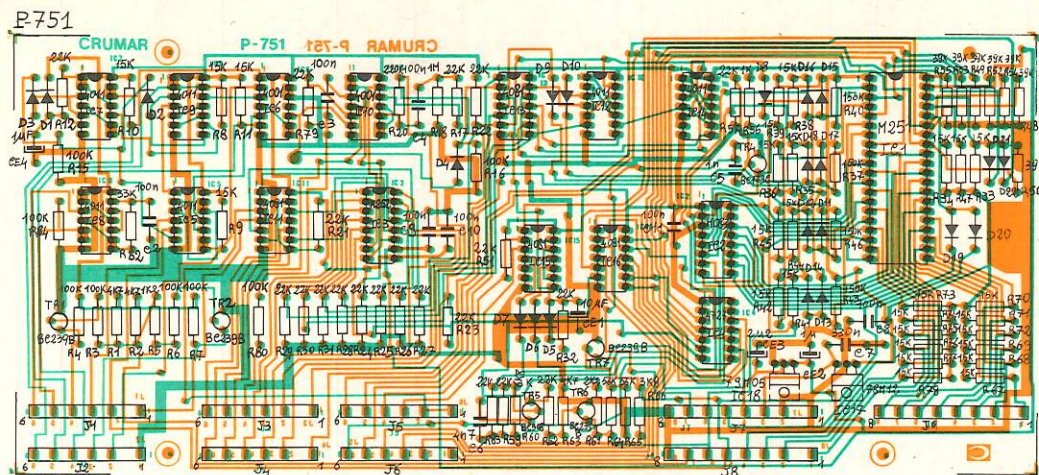
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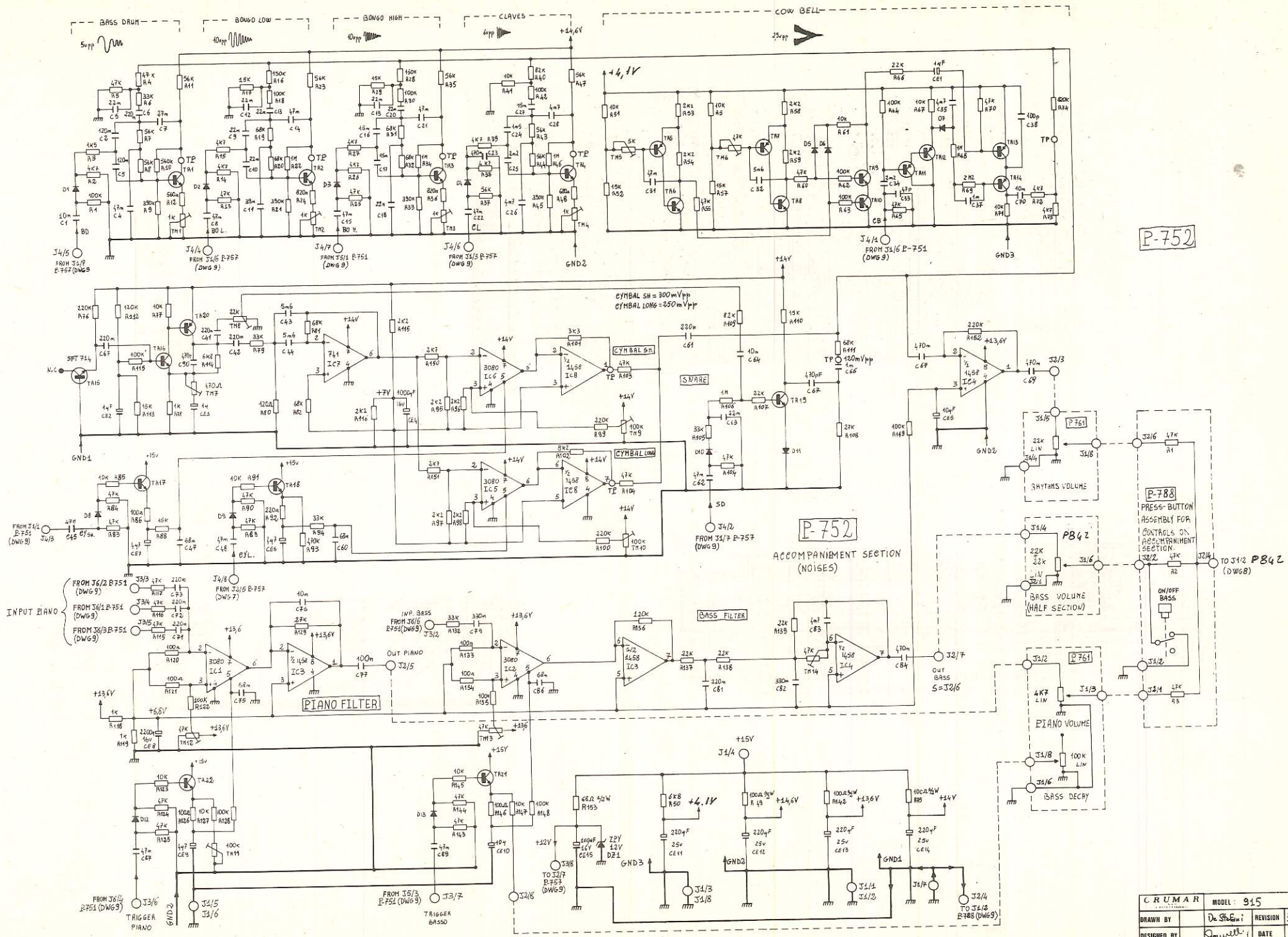
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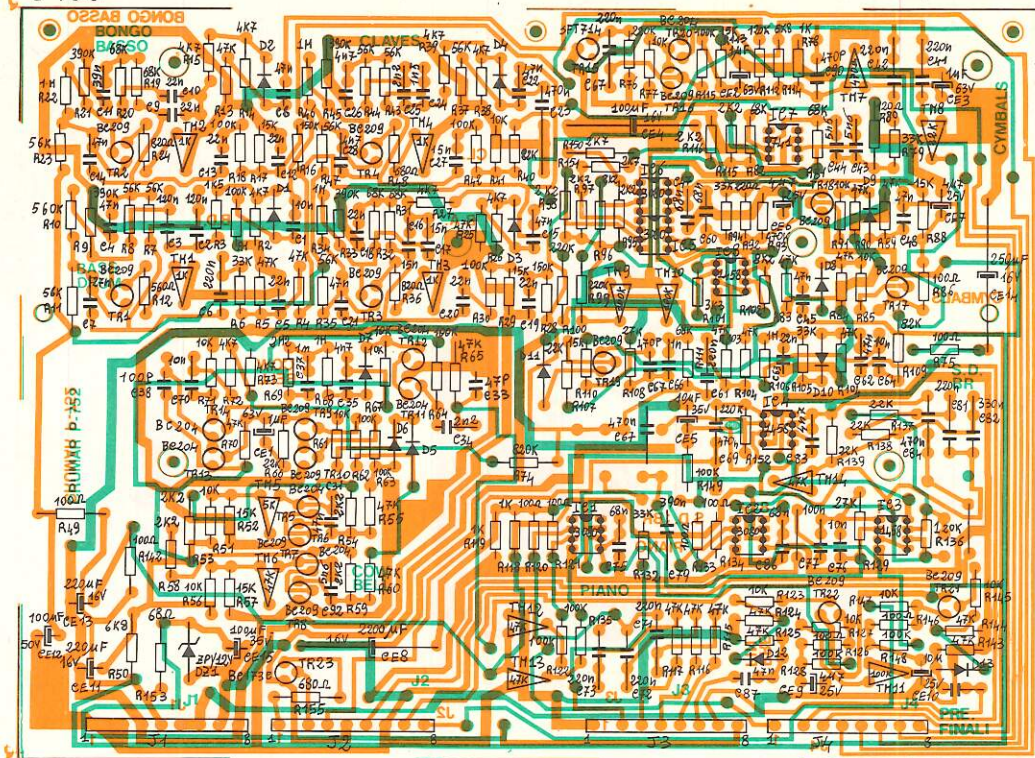




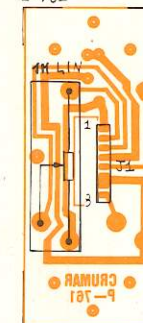
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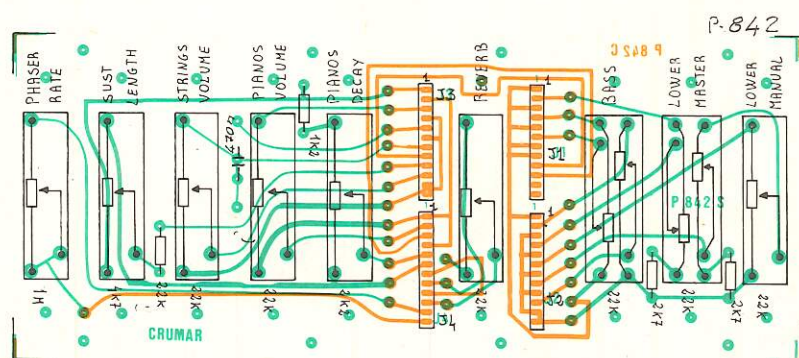
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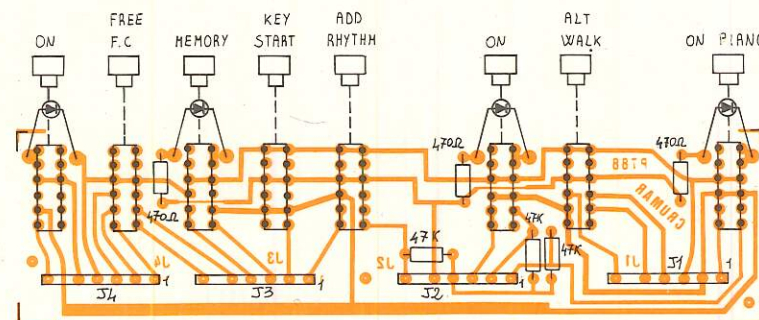
P-761



TEMPO

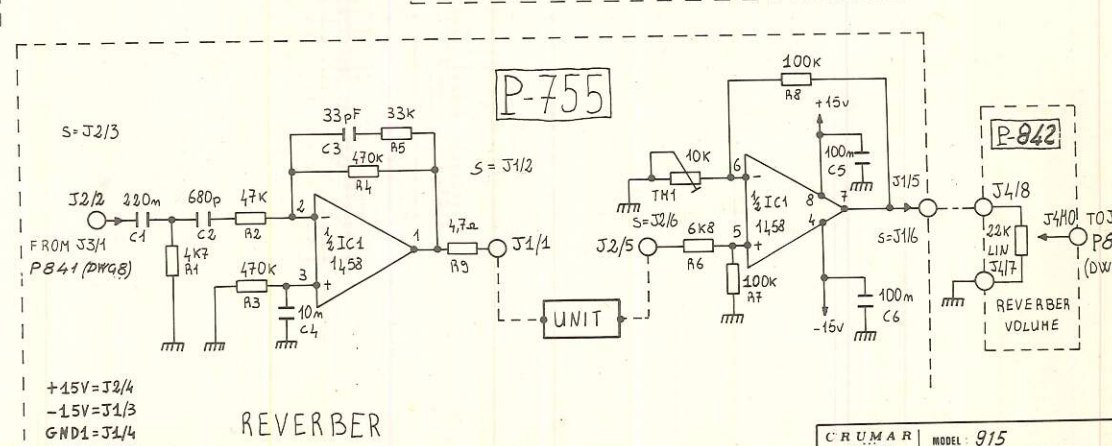
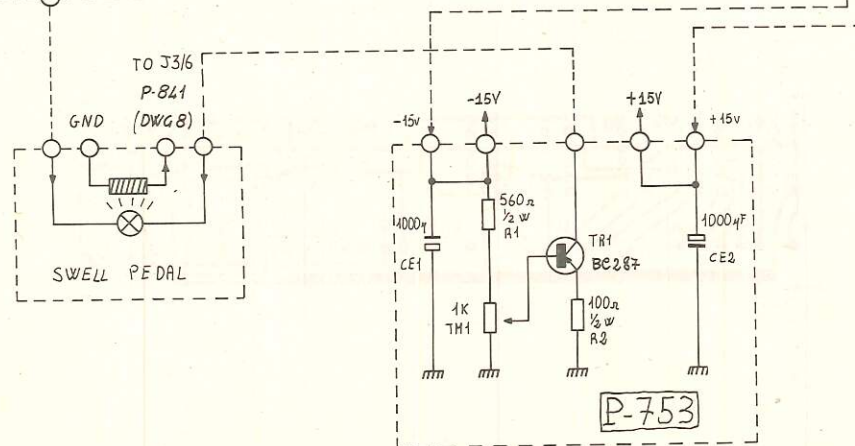
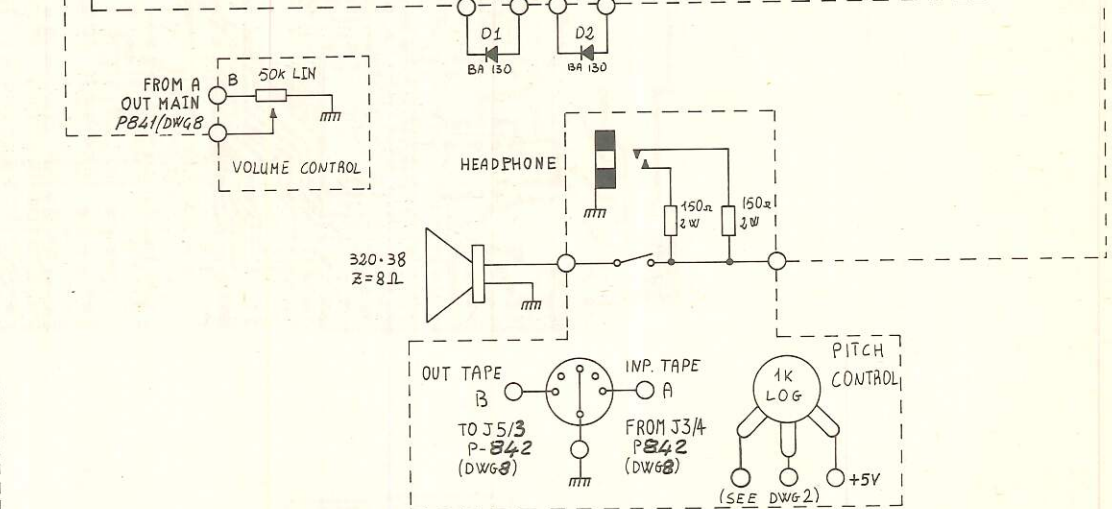
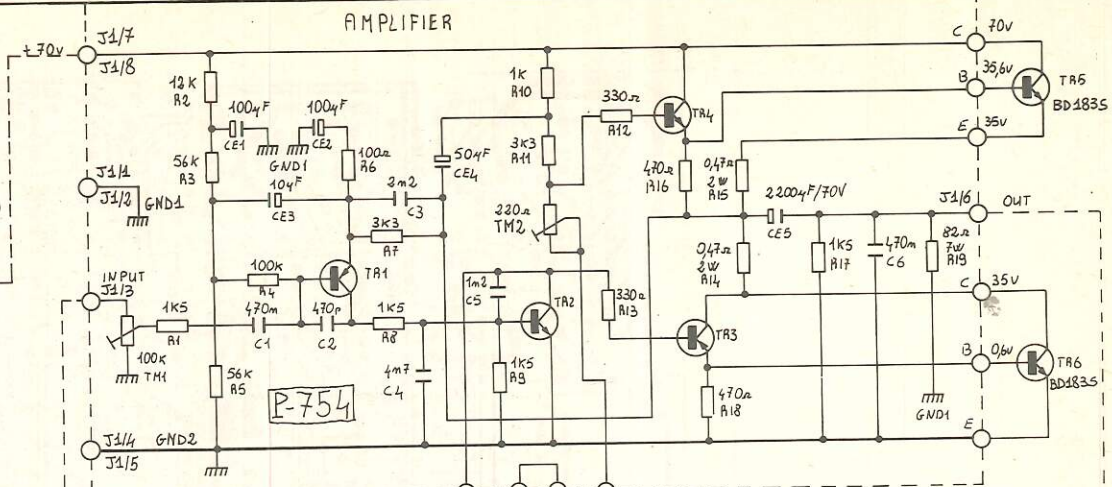
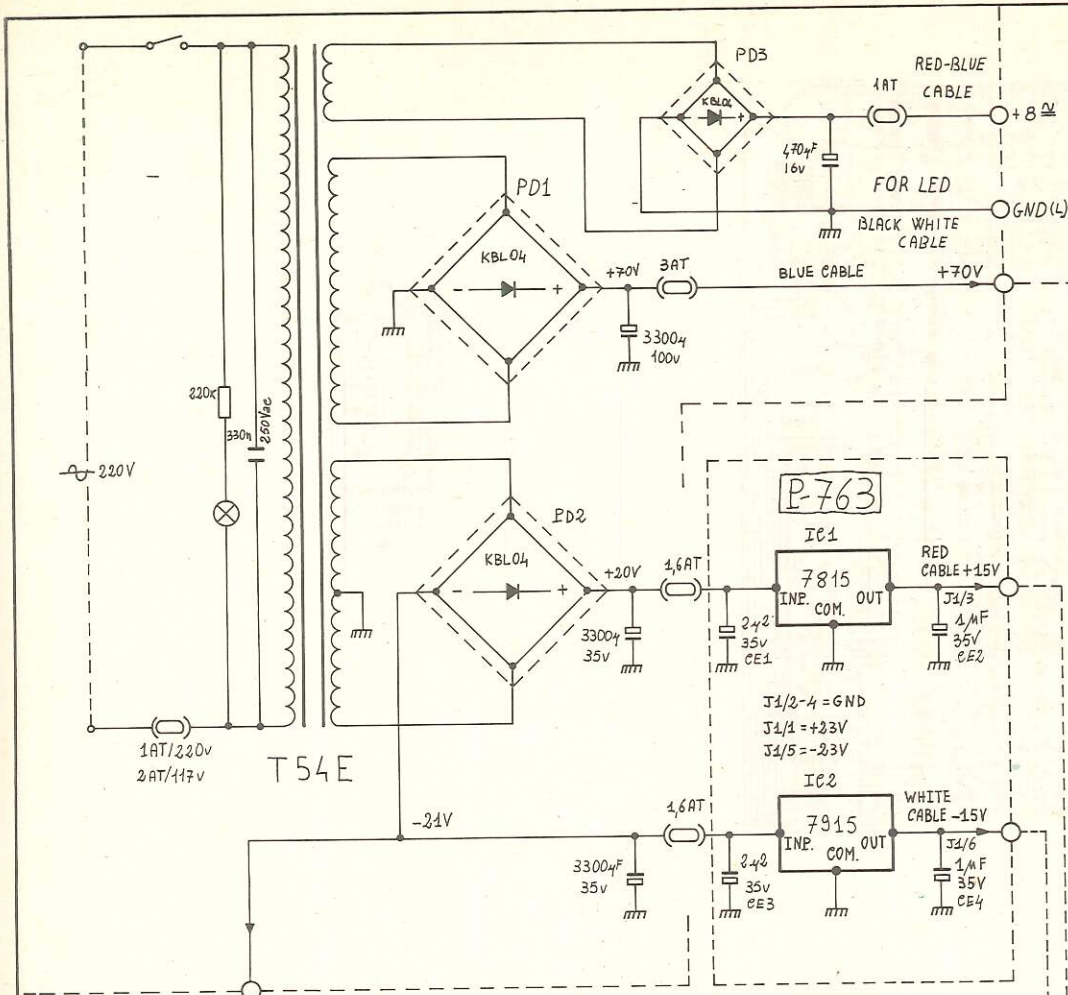


BASS



P-788

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DATE		



CRUMAR	MODEL: 915
DRAWN BY	REVISION 50-F-80
DESIGNED BY	DATE

MODEL 915

ELECTRONIC COMPONENT LIST

Schem. Ref.	Circuit	Type	Part Code
L.M. KEYING CIRCUIT (DWG1)			
P-843	Complete with Components		978002437
D1 ÷ D68	Diodes	BA130	65000001
U.M. KEYING CIRCUIT (DWG1)			
P-746	Complete with Components		978002435
D1 ÷ D88	Diodes	BA130	65000001
MASTER OSCILLATORS AND DIVIDERS (DWG2)			
P-822	Complete with Components		978002413
IC1	Voltage reference	741	68000059
IC2	Master Oscillator	7LLS221	68000058
IC3	Dual J-K Master Slave Flip-Flop with 4027 Set and Reset	4027	68000089
IC4	T.O.S.	MK50240	68000009
IC5 ÷ IC16	Divider	HBF4727	68000041
TR1	Buffer	BC173C	62120003
TR2	Voltage Reference	BC286	62110002
TR3 ÷ TR14	Buffer	BC308B	62210001
RT1	Voltage Regulator	78L05	62000031
D1 ÷ D264	Diodes	1N4149	65000007
MODULES FOR ELECTRONIC KEYBOARD (DWG3)			
P-818	Complete with Components		978002409
TR1 - TR2	Gate	BC308B	62210001
TR3	Preamplifier	BC173C	62120003
D1 ÷ D31	Diodes	1N4149	65000007
ELECTRONIC KEYBOARD (DWG3)			
P-819	Complete with Components		978002410
D1 ÷ D20	Diodes		65000001
FLUTE-PERCUSSION ACTIVATING (DWG4)			
P-776	Complete with Components		978002355
FLUTE FILTER - MIXER STRINGS AND PERC. ENVELOPE (DWG4)			
P-830	Complete with Components		978002421
IC1	Voltage Reference and Perc. Envelope	358	68000093

MODEL 915

ELECTRONIC COMPONENT LIST

Schem. Ref.	Circuit	Type	Part Code
IC2	Mixer	4011	68000034
IC3 ÷ IC7	Filter Preamplifier	1458	68000053
IC8	Filter Preamplifier	741	68030141
TR1 - TR4	Buffer	BC173C	62100003
TR2	Voltage Regulator	BC286	62110002
TR7	Buster Power	BC286	62110002
TR3 - TR5 - TR6	Gate	BC308	62210001
TR12 ÷ TR16	Buffer	BC173C	62100003
TR8 ÷ TR11	Preamplifier	BC173C	62100003
RT1	Voltage Regulator	LM317T	62110034
DZ1	Diode Zener	ZPY4,7V	67000002
D1 ÷ D10	Diodes	BA130	65000001
DELAY LINES (DWG5)			
P-771	Complete with Components		978002350
IC1 ÷ IC3	Oscillators	1458	68000107
IC4	Preamplifier	1458	68000107
TR1 - TR2	Limiter	BC308B	62210001
TR2 - TR4	Limiter	BC239B	62120001
TR5	Emitter Follower	BC173C	62120003
DELAY LINES (DWG5)			
P-790	Complete with Components		978002369
IC1	Quad 2-Input NAND Schmitt Trigger	4093	68000050
IC2	Delay-Line	TDA1022	68000084
IC3	Filters	1458	68000107
D1 ÷ D2	Diodes	BA130	65000001
PEDAL BASS FILTER AND LOWER MANUAL MIXER (DWG6)			
P-742	Complete with Components		978002316
IC1 - IC2	Filter Preamplifier	1458 or 4558	68000062
IC3	Preamplifier	1458 or 4558	68000062
IC4	Mixer	1458 or 4558	68000062
IC5	V.C.A.	3080	68000066
IC6	Pedal Frequency Generator	M147	68000087
TR1	Gate	BC308	62210001
TR2	Gate	BC173B	62120001
DZ1	Diode Zener	ZPY4,3V	67000075
D1	Diode	BA130	65000001

MODEL 915

ELECTRONIC COMPONENT LIST

Schem. Ref.	Circuit	Type	Part Code
PEDAL-BOARD KEYSWITCHES (DWG6)			
P-814	Complete with Components		978002397
BASS CONTROLS (DWG6)			
P-777	Complete with Components		978002356
VOLUME CONTROLS (DWG6)			
P-842	Complete with Components		978002357
LOWER MANUAL FLUTE CONTROLS (DWG6)			
P-787	Complete with Components		978002366
D1 ÷ D2	Diodes	BA130	65000001
ROTATING SOUND SISTEM (DWG6)			
P-775	Complete with Components		978002354
IC1	Delay Line	TDA1022	68000084
IC2	Quad 2-Input NAND Buffered B Series Gate	4011	68000034
IC3 1/2	Filters	LM349	68030132
IC3 1/2	Oscillator	LM349	68030132
IC5-IC6	Analog Switch	4066	68000094
TR7	Mixer	BC239B	62120001
TR5	Switch	BC239B	62120001
TR6	Emitter Follower	BC239B	62120001
TR1 ÷ TR2	Emitter Follower	BC173C	62100003
TR3	Emitter Follower	BC308B	62210001
TR4	Current Source	BC308B	62210001
D1 ÷ D11	Diodes	BA130	65000001
PHASER-MIXER AND FINAL PRE-AMPLIFIERS (DWG8)			
P-841	Complete with Components		978002434
IC1 ÷ IC2	Mixer Preamplifier	1458	68000053
IC5 - IC6	Filter Preamplifier	1458	68000053
IC3	Modulator	3080	68000066
IC4	Preamplifier	741	68030141
IC8 ÷ IC11	V.C.A.	3094	68000098

MODEL 915

ELECTRONIC COMPONENT LIST

Schem. Ref.	Circuit	Type	Part Code
IC12	Oscillator	3094	68000098
TR1	Emitter Follower	BC173C	62120003
TR6 - TR9	Preamplifier	BC173C	62120003
TR5	Preamplifier	BC308	62210001
TR7 - TR8	Oscillator	BC308	62210001
D1 ÷ D3	Diodes	BA130	65000001
ACCOMPANIMENT SECTION (LOGIC) (DWG9)			
P-751	Complete with Components		978002324
IC1	Accompaniment Unit	M251	68000109
IC2	T.O.S.	M083	68070129
IC3	Rhythms Memory	M252	68040130
IC4	Divider	HBF4727	68000041
IC6-IC10	Quad 2-Input NOR Gate	4001	68000020
IC12-IC14	Quad 2-Input NAND Buffered Series Gate	4011	68000034
IC11-IC13	Quad 2-Input AND Buffered B Series Gate	4081	68000019
IC15-IC16	Quad 2-Input AND Buffered B Series Gate	4081	68000019
IC17	Voltage Regulator	78M12	62110027
IC18	Voltage Regulator	79M05	62110029
TR1-TR2	Switch	BC239B	62120001
TR6-TR7	Buffer Preamplifier	BC239B	62120001
TR4	Buffer	BC173C	62120003
TR5	Buffer Preamplifier	BC308B	62210001
D1 ÷ D22	Diodes	BA130	65000001
PRESS-BUTTON ASSEMBLY FOR RHYTHMS ON ACCOMP. SECTION (DWG9)			
P-757	Complete with Components		978002330
PRESS-BUTTON ASSEMBLY FOR CONTROLS ON ACCOMP. SECTION (DWG9)			
P-788	Complete with Components		978002367

MODEL 915

ELECTRONIC COMPONENT LIST

Schem. Ref.	Circuit	Type	Part Code
P-761	VOL. REVERB - VOL. CHORUS - VOL. TEMPO RHYTHMS - VOL. PIANO BASS (DWG9)		
	Complete with Components		978002338
P-752	ACCOMPANIMENT SECTION (LOGIC) (DWG10)		
	Complete with Components		978002325
IC1-IC2-IC5	Modulator (V.C.A.)	3080	68000066
IC6	Cymbal filter	741	68000059
IC7	Preamplifier	1458	68000107
IC3-IC4-IC8	Bass Drum Generation	BC209	62120001
TR1	Bongo Low Generation	BC209	62120001
TR2	Bongo High Generation	BC209	62120001
TR3	Claves Generation	BC209	62120001
TR4	Cow Bell Oscillator	BC209	62120001
TR6-8-9-10	Cow Bell Oscillator	BC204	62210001
TR5	Cow Bell Oscillator	BC204	62210001
TR7	Cow Bell Oscillator	BC204	62210001
TR11-12	Cow Bell Gate	BC204	62210001
TR13-14	Cow Bell Preamplifier	BC204	62210001
TR16	Preamplifier	BC209	62120001
TR20	Preamplifier	BC204	62210001
TR17	Cymbalsh. Envelope	BC209	62120001
TR22	Envelope	BC209	62120001
TR21	Envelope	BC209	62120001
TR18	Cymbal Long Envelope	BC209	62120001
TR19	Snare Generation	BC209	62120001
TR15	Noise	SFT714	62210002
TR23	Switch	BC173C	62120003
D1 ÷ D13	Diodes	BA130	65000001
DZ1	Diode Zener	ZPY12V	67000010

VOL. REVERB - VOL. VIB. CHORUS - VOL. TEMPO RHYTHMS - VOL. PIANO BASS (DWG10)

P-761 Complete with Components 978002338

PRESS-BUTTON ASSEMBLY - FOR CONTROLS ON ACCOMPANIMENT SECTION (DWG10)

P-788 Complete with Components 978002367

MODEL 915

ELECTRONIC COMPONENT LIST

Schem. Ref.	Circuit	Type	Part Code
P-753	POWER-SUPPLY FILTERS (DWG10)		
	Complete with Components		978002326
TR1	Lamp Current Regulator	BC287	62110003
P-754	AMPLIFIER (DWG10)		
	Complete with Components		978002327
	Unit Amplifier	BC327	62110007
	Unit Amplifier	L01	62110004
	Unit Amplifier	BC287	62110003
TR4	Unit Amplifier	BC286	62110002
P-755	REVERB (DWG10)		
	Complete with Components		978002328
IC1	Driver And Amplifier	1458	68000107
P-763	POWER SUPPLY (DWG10)		
	Complete with Components		978002341
	Voltage Regulator	7815	62110020
	Voltage Regulator	7915	62110022
	Rectifier Bridge	KBL04	66000006
PD1 ÷ PD3			

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